PATENT SPECIFICATION (11) 1 280 932

1 280 932

DRAWINGS ATTACHED

(21) Application No. 45142/70 (22) Filed 22 Sept. 1970

(31) Convention Application No. P19 51 113.8 (32) Filed 10 Oct. 1969 in

(33) Germany (DT)

(45) Complete Specification published 12 July 1972

(51) International Classification B30B 9/30 // B65B 27/12

(52) Index at acceptance

B5F 22A2 23A 23D2 23D6 23E2 23K AX1

B8C 10B2C1 10BB3X 10D3B2 10E 10S2A 10S2B 10T1A 1C2B

(54) PROCESS AND APPARATUS FOR THE FORMING AND PACKAGING OF BALES

(71) We, LINDEMANN MASCHINENFABRIK G.M.B.H., a German Company of Erkrather Strasse 401, Düsseldorf, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

In the baling and packaging under compression of materials which expand when the pressure is released, for example many fibrous materials, it is desirable to save labour and save time by making as many as possible of the individual operations involved automatic. Many of these individual operations, mainly concerned with the baling, have already been automated without this involving any special difficulties. There remains however, the wrapping or packaging stage, which is comparatively difficult to make automatic.

The usual method for wrapping or packaging a bale is as follows. In an automatic baling press two tying plates are mounted in the press box, the tying plates usually forming the end walls of the box. Before filling the press box with the fibrous material to be packed, a sheet of flexible foil is placed in position by hand over each of the two tying plates, each sheet being wrapped back over the sidewalls of the tying plate with the ends of the sheet usually being folded on the remote surface of the tying plate, as though the tying plate itself were being wrapped. After the fibrous material has been positioned in the press box, and then compressed between the tying plates or end walls, the doors of the press box are opened and the sheets of foil are unfolded and the ends wrapped by hand over and around the sides of the compressed bale, forming a double layered wrapping. The two layers of wrapping are then welded together by hand, using a hot iron.

It is highly desirable to replace this time consuming manual operation by an automatic process. In this respect it is known to replace the flexible foil, usually a weldable plastics material, by cardboard, particularly corrugated cardboard, and the procedure for packing a compressed bale of fibrous material using corrugated cardboard is as follows. Two open mouthed cardboard boxes are used for packing each bale, each open mouthed cardboard box consisting of a bottom and four sides. Each box is positioned in the press box of the baling press with its bottom supported on one of the two relatively movable end walls of the press box, so that the open mouths of the two boxes face each other. Each end wall of the press box usually consists of a tying plate, and therefore the two open mouthed cardboard boxes are mounted, facing each other, with their bottoms resting against the two tying plates. After filling the press box with the fibrous material, the tying plates are relatively moved towards each other so that the material is compressed and one open mouthed box is pushed partly inside the other to form a closed cardboard casing around the compressed fibrous material. The whole is then tied, using wire or ribbon. This method can be made largely automatic but has certain disadvantages. In the first place the open mouthed cardboard boxes cannot be stored conveniently as required, because they would take up a great deal of space. They have to be stored folded flat. In the manner customary for containers of this kind, and this involves preparing the containers, i.e. squaring them up, by hand before forming each bale. This is a time consuming operation and requires manual labour.

A further disadvantage of using cardboard containers for packaging baled materials is that cardboard is not a yielding material, as is a plastic foil. The completed bale applies a considerable expansive pressure to the walls

of the container and to withstand this bursting pressure two or even three layers of corrugated cardboard have to be used. This increases the weight of the packaged bale. Furthermore the package is sensitive to impacts. If it is dropped on a corner, as often happens during ordinary handling such as during loading a vehicle, the cardboard walls burst at the corners and the contents bulge out. Finally, since cardboard disintegrates in the rain, bales packaged in cardboard containers have to be stored and transported under cover.

According to the present invention therefore, a process for baling and packaging under compression in a baling press materials which expand when the pressure is released comprises mounting a sheet of flexible wrapping material on each end wall of the press box of the baling press so that one of the sheets forms a base portion on its associated end wall and at least one pair of opposed side portions extending towards the other sheet, and the other sheet forms a base portion on its associated end wall and at least one pair of opposed side portions aligned with the side portions of the first sheet but extending away from the first sheet, positioning the material to be packed between the end walls of the press box relatively moving the end walls towards each other to force the material to be packed between the side portions of the first sheet of wrapping material and subsequently to compress the material until the second sheet of wrapping material is moved between the side portions of the first sheet so that the side portions of the two sheets overlap, joining the overlapped side portions to each other, and relatively moving the end walls apart whereupon the packed material expands and pushes the second sheet inside out. This provides a bale which is wrapped in a continuously extending sheet which is under tension. Preferably each sheet of wrapping material is formed with side portions extending from the whole of the periphery of the base portion so that an open-mouthed bag is formed. With this arrangement the baled material is packed in a container of flexible wrapping which completely surrounds and encloses the bale. The enclosure is under tension due to the expansive forces of the baled material which is still under compression. Preferably the wrapping material is a flexible synthetics plastics and the overlapping side portions of the two sheets are joined by heat welding.

Such a process in accordance with the invention is at least as highly automatic, and may be more so, as the process involving corrugated cardboard wrapping material. However, the invention overcomes all the disadvantages mentioned earlier concerning bales packaged in cardboard. The plastic skinned bale formed by the process of the present invention is insensitive to impacts because the skin is flexible. The package is unaffected by rain or moisture and the skin yields sufficiently to absorb the expansive pressure of the baled material. The wrapping material has a negligible weight compared with two or three layers of corrugated cardboard, and in the case of plastic bag parts, can be conveniently stored, stacked flat on top of each other. Each bag part can be easily opened out before use and the problem of supporting the walls of the second bag part as it is pushed into the first bag part is solved by inverting the bag and pushing it in base first. The walls of the bag-part are then supported by the sides of the end wall. As already mentioned the two bag parts are then welded together and on release of the baling pressure the second bag part is forced inside out to assume a normal cap shape by the expansive pressure of the baled material. A further advantage is that with cardboard wrapping material the press box door has to be opened for the two box parts of the container to be joined together by hand, whereas in the present process the two bag parts may be joined together automatically, for example by welding or stapling, before the press box door is opened. The necessary welding heads or stapling devices are installed in the sidewalls of the press box, and can be operated automatically just after the bale of fibrous material has been formed and pushed completely into the first bag-part.

The packaged bale may be tied loosely around with cord or ribbon before the packaged material is allowed to expand by relatively moving the end walls apart, so that on expansion the volume of the bale increases and pulls the tying cord or ribbon tight. However, the packaged bale need not necessarily be tied, depending on the nature of the material being baled and on the strength of the wrapping material used.

Preferably the extent of the side portions of the first sheet is much greater than that of the side portions of the second sheet. In the case where the sheets form bags, the second bag is much shallower than the first and forms a cap part for the bale, the first bag forming a base or container for the bale.

A baling press suitable for carrying out the process in accordance with the invention comprises a press box with a pair of end walls which are relatively movable towards and away from each other and which are arranged so that one can support a first sheet of flexible wrapping material with a base portion of the sheet lying on it and at least two opposed side portions of the sheet directed towards the other end wall, and the other can support a second sheet of flex-

ible wrapping material with a base portion of the sheet lying on it and at least two opposed side portions of the sheet aligned with the side portions of the first sheet but directed away from the first end wall, means for positioning material to be packed between the two end walls, and means mounted in the side walls of the press box for heat welding the side portions of the two sheets together when they become overlapped.

Preferably the walls of the press box are equipped with suction devices for holding the first sheet in position. Each end wall of the press box may have associated with it a feeding device for feeding the relevant bag part into position on the end wall, either the feeding device being arranged to travel towards the end wall, or the end wall being arranged to travel towards the feeding device. In this respect at least one of the feeding devices may take the form of a suspension conveyor which travels transversely through the press box. An example of a baling and packaging process in accordance with the invention, and a baling press for use in the process will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a front elevation of the baling press;

Figure 2 shows diagrammatically a storage arrangement for the two parts of a bag for packaging a bale and a feeding system for feeding the two bag parts into the bale-forming press;

Figure 3 is a longitudinal section through part of the bale-forming press of Figure 1 showing in particular the press box;

Figure 4 corresponds to figure 3, but shows the door of the press box open and a packed bale being pushed out;

Figure 5 is a transverse section taken along the line V-V in figure 4;

Figure 6 corresponds to figure 5, but shows the door of the press box in the closed position.

Figure 7 is drawn to a much larger scale and illustrates a mechanism incorporating spreader fingers for spreading open the mouth of the upper part of a bag ready to receive a pressed bale; and,

Figures 8 to 11 represent diagrammatically four stages of the packaging of a bale.

Figure 1 shows a vertical double-box baling press consisting of a preliminary press 1, whose plunger acts downwards, and a final press, or bale-forming press 2, whose plunger acts upwards.

Serving the two presses there is a double press box 3, which is rotatably mounted about a vertical axis so that two individual press boxes 3a and 3b can be brought alternately into cooperation with each of the two press plungers. The bale-forming press 2 has a stationary press box 4, for the final bale-forming operation and for the bale tying or packaging process. The preliminary press 1 has a charging funnel which is not shown in the drawing, through which the fibrous material to be packed is fed to the press. All three press boxes i.e. the two interchangable press boxes 3a and 3b and the stationary press box 4, are of rectangular cross section. A part of the stationary press box 4 has a slightly larger cross section, compared with the individual press boxes 3a and 3b.

Figure 2 shows an arrangement for feeding bags for packaging the bales to the bale-forming press 2. Each bag consists of two parts, a bag-base part which is comparatively deep, and a bag-cap part which is comparatively shallow. Both bag parts are stored and conveyed to the press upside down, i.e. with the mouth of each bag part facing downwards. Figure 2 shows a storage device 5 for the bag-caps 6, and an overhead conveyor 7 for the bag-bases 8. The storage device 5 and the conveyor 7 may be devices of a known kind. In the present example the bag-caps 6 are lifted from the storage stack 5 by means of a suction plate 9, which lifts the bag-cap 6, swings it about a pivot column, and then lowers it mouth downwards over a tying plate 10 so that the bag-cap 6 covers the tying plate 10 with the side walls of the bag-cap 6 overlapping the sides of the plate 10. The tying plate 10 has previously been driven out to one side of the bale-forming press 2 and receives the cap 6 in this outward position (Figure 2). The bag-bases 8 are conveyed to the bale-forming press 2 upside down as follows. The conveyor 7 has L-shaped hooks 12 which engage loops on each bag-base 8. The conveyor 7 can, if desired, pick up and convey a number of bag-bases 8 in succession, depending on its length, and in this example consists of two parallel conveyer chains 7a, positioned on opposite sides of an upper tying plate 13 of the stationary press box 4.

The bag-bases 8 and bag-caps 6 have rectangular cross sections to correspond with that of the stationary press box 4. Each bag-base 8 and bag-cap 6 has a bottom, four side walls and an open mouth, and is made of a flexible, weldable synthetic plastics material. As explained earlier, the bag-caps 6 are shallow in comparison with the bag-bases 8 which are deep.

The final press, or bale-forming press 2 is shown more clearly in Figure 3, and comprises an upwardly acting plunger shown at 14, the press box 3a which is interchangable with the other box 3b of the rotary double press box 3, and the stationary press box 4. The stationary press box 4 has at least one door 15, the lower tying plate 10 and the upper tying plate 13. Each of the interchangable press boxes 3a and 3b has pivoted

retainer fingers 16, capable of swinging inwards to retain a compressed plug of fibrous material within the box and prevent it from expanding upwards until it is so desired, at which time the fingers 16 are swung outwards. Opposite the door 15 of the stationary press box 4, the side wall 17 is provided at its lower end with a hydraulically driven pusher 18, which has a nose plate 19. When the pusher 18 is in the fully retracted position shown in Figure 3 the nose plate 19 rests in a recess in the wall 17 so that the surface of the nose-plate 19 is flush with the inner surface of the wall 17. The pusher 18 is for driving the lower tying plate 10 out of the press box 4 to remove a packed bale when a pressing and baling and packaging cycle is completed. Subsequently the pusher 18 is retracted to return the plate 10 which has been fitted with a new bag-cap part into the press box 4. Above the level of the plate 10, the internal cross-section of the box 4 is slightly larger than that below in order to accommodate the thickness of the bag-base wall when this is fitted in the box 4, so that when a plug of fibrous material is pushed upwards into the bag-base it does not strike the rim of the mouth of the bag-base, causing the wall of the bag-base to crumple.

As shown in figure 7 the sidewalls of the stationary press box 4 have openings 20 situated, when the bag-base part 8 is in position, just below the mouth of the bag-base part. Four spreader fingers 21, see figures 5 to 7, one for each corner of the bag-base mouth, are arranged so that each can be driven inwards through its sidewall opening 20 and then upwards and outwards so that together they spread the mouth of the bag-base open. Each finger 21 is pivoted at its outer end on a crank pin or eccentric on a crank disc 22, the finger also being pivoted near its middle on a pivot pin 25 at the end of a rocking arm 24 which rocks about a stationary pivot pin 23. The effect produced is that when the crank disc 22 is rotated anti-clockwise each finger 21 travels through the paths I, II, IV, III, indicated by the arrows in Figure 7, the fingers 21 entering the mouth of the bag-base part 8, spreading the mouth open and finally clamping down the material of the bag-base part against the inner surface of the sidewall 17, at least at the corners of the bag-base mouth. The fingers 21 may be driven by a different mechanism if desired. The sidewall of the stationary press box 4 also contains blower nozzles 26, situated below the level of the mouth of the bag-base part 8, for blowing the bag-base open after the door 15 has been closed. It should be observed that when a bag-base part has been driven into the stationary press box 4 by the conveyor 7, the bag-base has not yet assumed its fully expanded shape, that is to say it is still to some extent folded. Consequently, precautions have to be taken to ensure that the material of the bag-base does not get pinched by the closing door 15. For this purpose the edges of the door 15, and the edges of the door frame, have projecting tongues 27, 28, 29, 30, as shown in figures 5 and 6, which enter into corresponding slots as the door is closed, pushing the material of the bag-base part safely out of the way.

For the subsequent welding process, i.e. the welding of the bag-cap part to the bag-base part after the base has been filled with fibrous material, there are welding devices 31, as shown in figure 4, in the sidewalls of the stationary press box 4, with welding heads 32 which can be driven inwards for effecting the welding. The welding heads 32 are positioned above the level of the bag-base mouth, to give room below for the spreader fingers 21.

The process of forming, bagging and tying a bale of fibrous material is as follows.

Starting from the position shown in figure 4, in which a completed, bagged and tied bale 33 has been driven sideways out of the box 4 of the bale-forming press 2 by the pusher 18, the bale 33 is removed and a fresh bag is then conveyed in two parts into the press box 4, as indicated in figure 2. In this a bag-cap part 6 is lifted from the storage device 5 and mounted upside down over the lower tying plate 10; the sidewalls of the bag-cap covering the sides of the tying plate 10, and the pusher 18 pulls the plate 10 with its bag-cap 6 back into the stationary press box 4 where it rests on the upper surface of the plunger 14 which is in raised position. The plunger 14 is moved downwards through the press box 3a carrying with it the plate 10, to a position below the lower end of the press box 3a. The tying plate 10 with its bag-cap part 6 however, is lifted from the plunger 14 and supported at the bottom of the press box 3a, in the position represented by broken lines in figure 2. With the mechanism in this position the double-press box 3 is rotated through 180°, bringing the press box 3a into engagement with the preliminary press 1. Fibrous material is forced through the charging funnel into the individual press box 3a and given a preliminary compression by the downwardly acting plunger of the preliminary press 1. The rotation of the double press box 3 also brings the second press box 3b into the bale-forming press 2, in place of the box 3a, the press box 3b containing a partly compressed plug of fibrous material from its previous sojourn at the preliminary press 1.

During these movements the conveyor 7 has conveyed a bag-base part 8 upside down into the stationary press box 4, positioning

the bag-base part under the upper tying plate 13. The door 15 is then moved into its closed position and at this point the press box 3b containing a partly compressed plug of fibrous material retained by the inwardly swung retainer fingers 16, is positioned in the press 2.

In the next stage of the process, the retainer fingers 16 are swung outwards, releasing the partly compressed plug in the box 3b so that it expands rapidly upwards, propelling a blast of air which inflates the bag-base part 8 positioned above the box 3b in the stationary press box 4. The inflation is completed by blowing air through the blow nozzles 26. During the blow process the spreader fingers 21 are actuated, spreading the four corners of the bag-base part outwards.

In the next stage, the upwardly acting plunger 14 pushes the fibrous material up into the bag-base part 8, compressing the material and pushing the bag-cap part 6 up into the mouth of the bag-base part 8, as represented in figure 8. The spreader fingers 21 are retracted, at the latest before the tying plate 10 begins to move downwards again on its return stroke.

Also before this, the welding heads 32 are actuated, as represented in figure 9, squeezing the two overlapped layers of bag material against the sides of the tying plate 10, whereupon the weld is made. However, no weld is made at the locations of the tying grooves. These locations are subsequently covered over by the tying cords or ribbons 34 as represented in figure 10. The tying is done in the press in known way, but the tying cord or ribbon is not drawn tight. When the tie has been made, the plunger 14 travels downwards, taking the tying plate 10 down with it. As a result the fibrous material in the bag expands slightly and pushes the bag-cap part 6 inside out, as represented in figure 11. This brings the tying cord or ribbon up tight so that a tightly tied, bagged bale of fibrous material is formed.

However, it is not always necessary to tie the bagged bale. In some cases it is sufficient to leave the two bag parts merely welded together at their edges, in which case the weld is made continuous all the way round. To obtain a continuous weld, the tying plate 10 is advanced until the continuous edge of the tying plate, or the edge of the plunger 14 comes opposite the welding heads 32. As a further possibility, a continuous weld may be made, and the bagged bale then tied as well, the tying plate 10 being retracted after the welding until its tying grooves emerge, allowing the bagged bale to be tied.

The door 15 is then opened and the completed bagged bale is driven out sideways from the stationary press box 4. In this example the pusher 18 pushes the tying plate 10 outward, taking the completed bale with it, but alternatively the bale may be conveyed out of the stationary press box 4 suspended from the L-shaped hooks 12 of the conveyor 7. It should be noted that although in the present example a double-box baling press has been described, the process in accordance with the invention can be worked with a single-box baling press, and it can be applied not only on a vertical baling press but also on a horizontally acting press if desired.

The preferred example of the process in accordance with the invention, which has been described above, is for forming bagged bales of the highest quality, i.e. in which the bale material is completely enclosed. As already mentioned the bags are initially in two parts, a bag-base and a bag-cap. The bag-base can be regarded as an open mouthed box, with a bottom and four sides, made of a flexible material, and the bag-cap is similar but shallower. However, within the scope of the invention the baling press can be used for forming wrapped bales of a more primitive kind, in which the wrapping is in the form of a band or wide sheet of foil which is wrapped around the bale. Each band or sheet of foil is fed into the press initially in two pieces, and each piece is supported from its centre portion of an end wall of the press box with opposed side portions extending downwards. The subsequent wrapping process is essentially as described above. The product is a wrapped bale, for example, of rags, cleaning wads and the like, which is not protected at the sides. This method is simpler and more economical. The sheets of wrapping material are easily prepared and stored and the sheet material is used economically.

WHAT WE CLAIM IS:—

1. A process for baling and packaging under compression in a baling press materials which expand when the pressure is released, comprising mounting a sheet of flexible wrapping material on each end wall of the press box of the baling press so that one of the sheets forms a base portion on its associated end wall and at least one pair of opposed side portions extending towards the other sheet, and the other sheet forms a base portion on its associated end wall and at least one pair of opposed side portions aligned with the side portions of the first sheet but extending away from the first sheet, positioning the material to be packed between the end walls of the press box relatively moving the end walls towards each other to force the material to be packed between the side portions of the first sheet of wrapping material and susequently to compress the material until the second sheet of wrapping material is moved between the side portions of the first sheet so that the

side portions of the two sheets overlap, joining the overlapped side portions to each other, and relatively moving the end walls apart whereupon the packed material expands and pushes the second sheet inside out.

2. A process according to claim 1, in which each sheet of wrapping material is formed with side portions extending from the whole of the periphery of the base portion so that an open-mouthed bag is formed.

3. A process according to claim 1 or claim 2, in which the wrapping material is a flexible synthetic plastics and the overlapping side portions of the two sheets are joined by heat welding.

4. A process according to claim 1, in which the end walls of the press box are in the form of tying plates and the packaged bale is tied loosely around with cord or ribbon before the packaged material is allowed to expand by relatively moving the end walls apart, so that on expansion the volume of the bale increases and pulls the tying cord or ribbon tight.

5. A process according to any one of claims 1 to 4, in which the extent of the side portions of the first sheet is much greater than that of the side portions of the second sheet.

6. A process according to any one of claims 1 to 5, in which a vertical baling press is used and the second sheet is mounted over the lower end wall of the press box so that the side portions of the sheet are directed downwwards.

7. A baling press for carrying out a process according to claim 1, comprising a press box with a pair of end walls which are relatively movable towards and away from each other and which are arranged so that one can support a first sheet of flexible wrapping material with a base portion of the sheet lying on it and at least two opposed side portions of the sheet directed towards the other end wall, and the other can support a second sheet of flexible wrapping material with a base portion of the sheet lying on it and at least two opposed side portions of the sheet aligned with the side portions of the first sheet but directed away from the first end wall, means for positioning material to be packed between the two end walls, and means mounted in the side walls of the press box for heat welding the side portions of the sheets together when they become overlapped.

8. A baling press according to claim 7, in which the walls of the press box are equipped with suction devices for holding the first sheet in position.

9. A baling press according to claim 7 or claim 8, which is provided with blow nozzles for blowing open the side portions of the first sheet.

10. A baling press according to any one of claims 7 to 9, having a number of spreader fingers mounted in the side walls of the press box and arranged to spread and hold open against the side walls the side portions of the first sheet.

11. A baling press according to any one of claims 7 to 10, having a pair of feeding devices for feeding the first and second sheets to their respective end walls.

12. A baling press according to claim 11, in which at least one of the feeding devices is in the form of a suspension conveyor which travels transversely through the press box to deliver its sheet to the end wall.

13. A vertical baling press according to claim 12, in which the conveyor serves the upper end wall and is also arranged to carry the packaged bale out of the press box.

14. A vertical baling press according to any one of claims 7 to 12 in which the lower end wall is arranged so that it can be driven transversely out of the press box while supporting a packaged bale.

15. A vertical baling press according to any one of claims 7 to 14 in which the side walls of the press box are provided with at least one door for the loading of the wrapping sheets and the removal of the packaged bales, the free vertical edges of the door or doors, and the corresponding edges of the stationary door frame having teeth which, when the door is being closed, cooperate with each other to prevent any part of the sheets from becoming pinched between the door and the frame.

16. A baling press according to claim 7, substantially as described with reference to the accompanying drawings.

17. A process according to Claim 1, substantially as described with reference to the accompanying drawings.

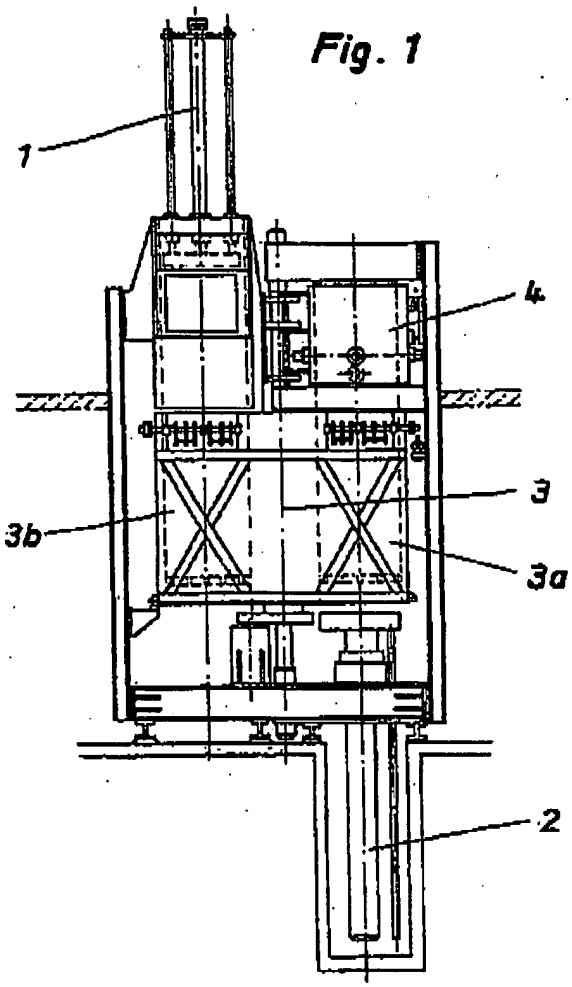
For the Applicants:-
GILL, JENNINGS & EVERY,
51/2, Chancery Lane,
London W.C.2.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1972.
Published at the Patent Office, 25 Southampton Buildings, London WC2A 1AY from which copies may be obtained.

1,280,932 COMPLETE SPECIFICATION
7 SHEETS

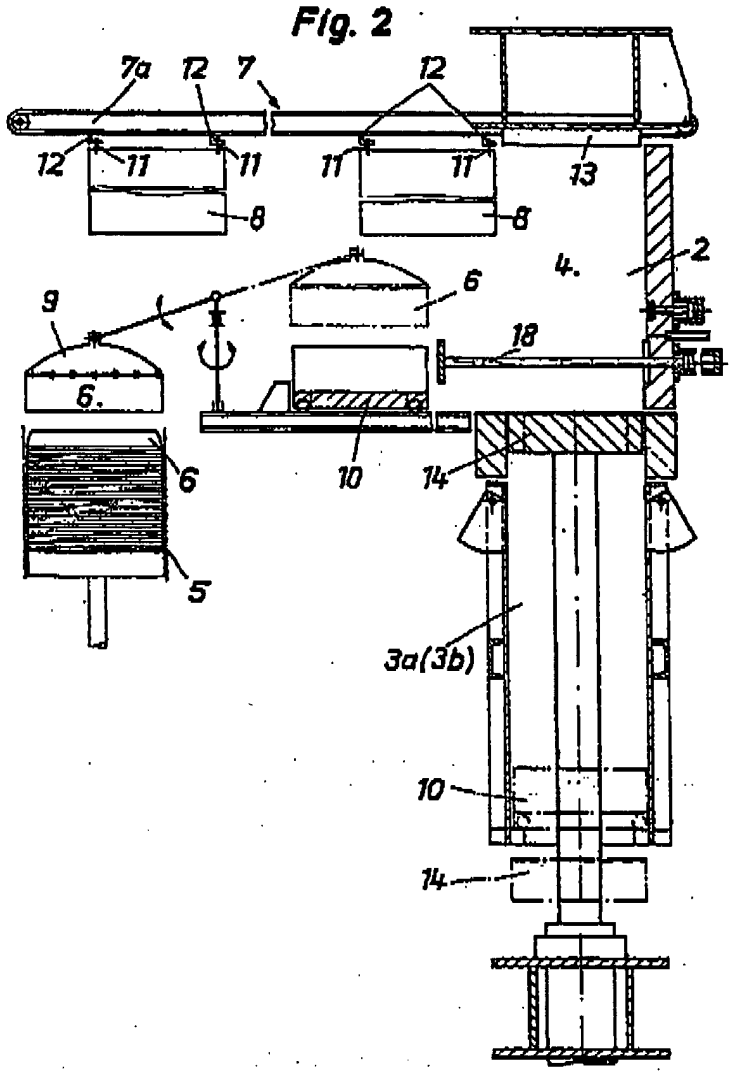
This drawing is a reproduction of the Original on a reduced scale.
SHEET 1

Fig. 1



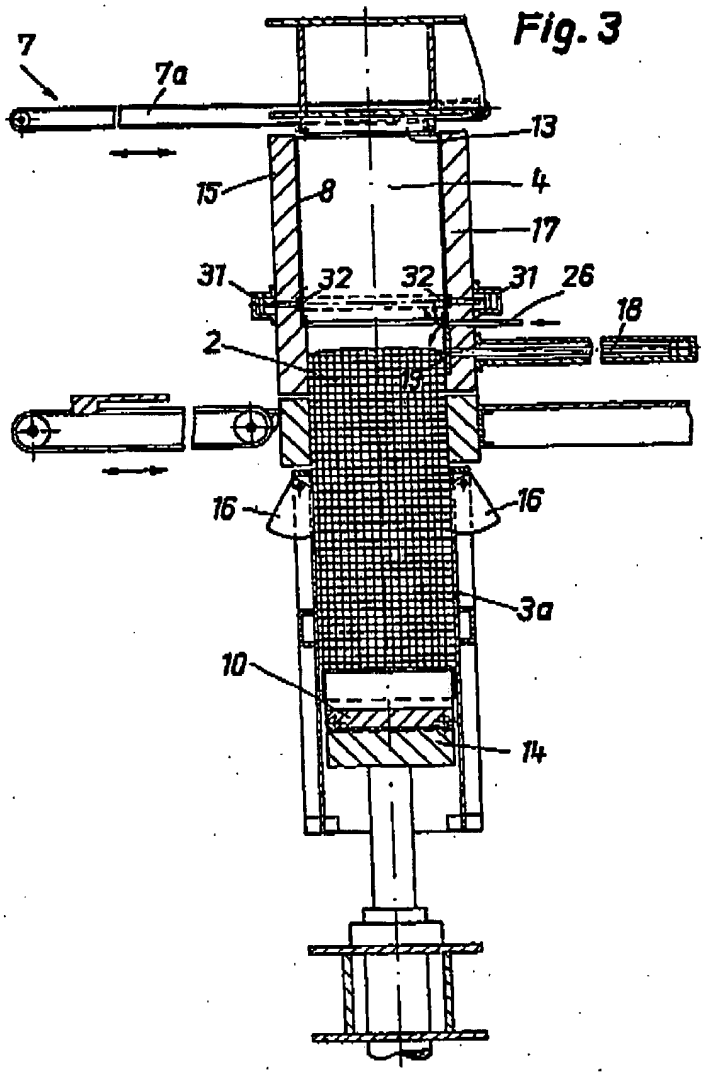
1,280,932
7 SHEETS
COMPLETE SPECIFICATION
This drawing is a reproduction of the Original on a reduced scale.
SHEET 2

Fig. 2



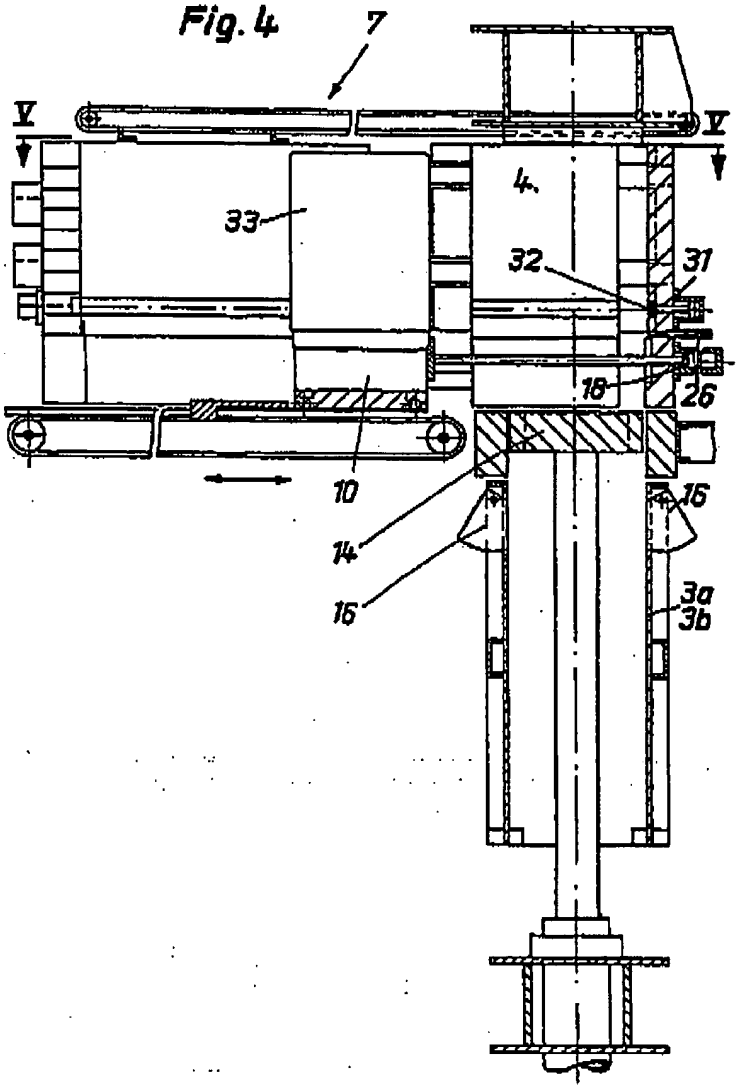
1,280,932 COMPLETE SPECIFICATION
7 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEET 3

Fig. 3



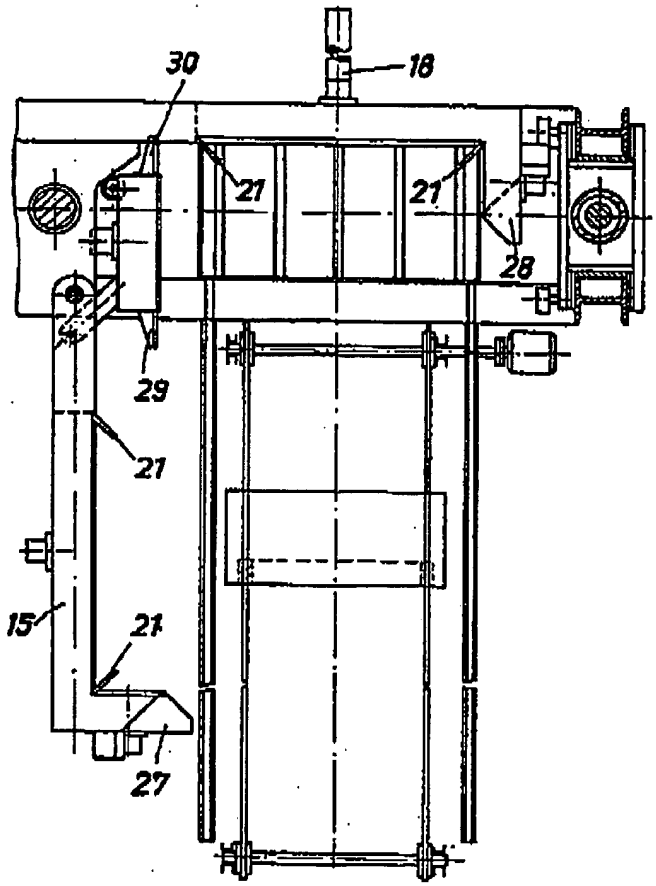
1,280,932
7 SHEETS
COMPLETE SPECIFICATION
This drawing is a reproduction of the Original on a reduced scale.
SHEET 4

Fig. 4



1,280,932
7 SHEETS
COMPLETE SPECIFICATION
This drawing is a reproduction of the Original on a reduced scale.
SHEET 5

Fig. 5



1,280,932
7 SHEETS
COMPLETE SPECIFICATION
This drawing is a reproduction of the Original on a reduced scale.
SHEET 6

Fig. 6

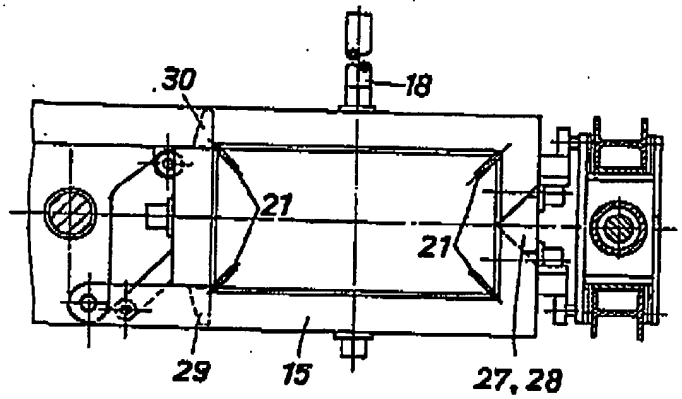
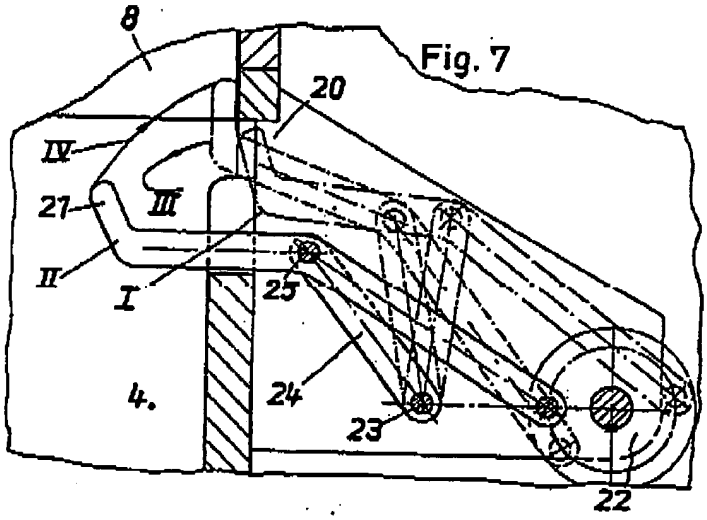


Fig. 7



1,280,932
7 SHEETS
COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.
SHEET 7

Fig. 8

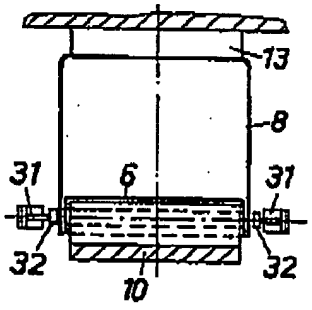


Fig. 9

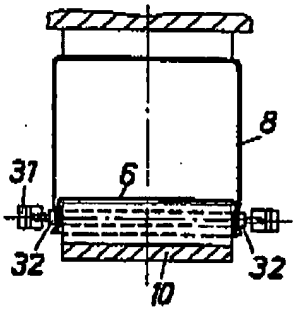


Fig. 10

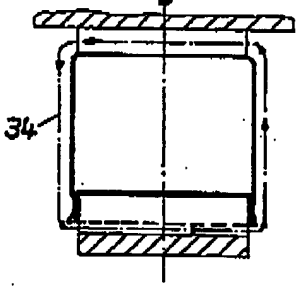


Fig. 11